Citizen Science: Data Collection in Storm Drain Marking Program

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History: The storm drain marking program in northeastern South Carolina began in 2009 and was developed by Coastal Carolina University undergraduate interns. The program encourages community involvement and educates the public about the effects of polluted storm water on the environment. Volunteers and school groups are able to get hands-on experience marking storm drains and recording observations. Involving the public raises awareness to local stormwater pollution issues and solutions to these problems and the final destination of stormwater. Data collection provides local stormwater departments with observational information of the condition of storm drains.

Hypothesis: After a marker has been applied to a storm drain, the storm drain will exhibit a decrease in trash debris over time.

Methods: Since the program began in 2009, a total of 554 drains have been marked (Figures 1 &2) in 15 different locations. Of the 15 original locations, 5 have been revisited and follow-up data has been collected for 202 drains (Table 1). Observations are recorded on a data sheet (Figure 3) while in the field. The information gathered on the data sheet is then transferred into a database. Once finalized, the information is forwarded to the local stormwater departments. After data sheets are received, the stormwater departments add the information to their GIS system and are able to investigate any problem areas. When the drains are revisited, new observations are recorded as well as the condition of the marker and markers are replaced as necessary. This study focused on observable trash debris inside of storm drains.

Figure 1

Figure 2

Coastal locations receive "Drains to Ocean" marker whereas inland locations receive "Drains to River" marker.

Type of Community (i.e. Business District, Neighborhood, etc):																							
Last Rain Event:																							
Current Weather Conditions:																							
Coastal Waccamaw Stormwater Education Consortium		Water Flowing			Debris Present		Floating Objects in Water		Odor Present		Oil Sheen Present		Erosion			Vegetation			Sediment Buildup			Comments
Storm Drain Unit Number	GPS Field Location Points	N	M	H	Yes	No	Yes	No	Yes	No	Yes	No	N	M	H	N	M	H	N	M	H	Explain What Was Found
	N																					
	W																					
	N																					
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Figure 3. Data collection spreadsheet where observations are recorded during storm drain visit.

Results: Since the program began, approximately 36% of the storm drains have been revisited (Table1, Figure 4). Debris found in storm drains included the following: plastics, Styrofoam, cigarette butts, bottles, balloons, paper, toys and bottle caps. The majority of the locations revisited exhibited a decrease in trash debris both inside of the drain and around the drain area (Figure 5). Public areas located near the beach have shown high densities of litter in the drain and the surrounding area. Multiple drains in the highly populated areas were also missing their marker or the marker exhibited considerable damage.

Follow-Up Data						
Date	Map Reference Number	Location	Number of Drains Marked	Date of Revisit	Percent Trash Debris in Drains Original Visit	Percent Trash Debris in Drains Revisit
4/29/2010	1	Coastal Carolina University	41*	8/28/2012	36.50%	0%
4/10/2010	2	Ocean Boulevard	37	4/12/2011	78.40%	62.10%
4/10/2010	3	Market Common	8	8/29/2012	25.00%	25.00%
5/22/2010	4	Garden City	33	9/5/2012	51.50%	30.30%
4/14/2011	5	Palmetto Glen	92	9/12/2012	19.60%	17.40%
* Only 32 storm drains could be revisited at CCU. Many sections of the campus are not allowing public access due to heavy construction						

Table 1. Compares percent of trash debris observed on original date of installation with percent of trash debris observed on date of revisit.

Figure 4. Revisited marking sites in northeastern South Carolina. Numbers on map are referenced in Table 1.

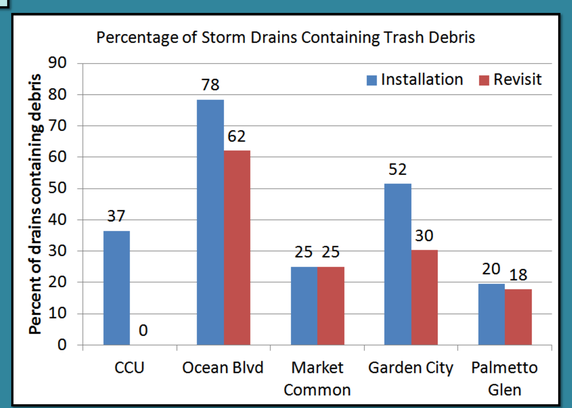

Figure 5. Percentage of storm drains that contained trash debris upon visitation. Original observations recorded at initial installation of markers is shown in blue. Follow-up observations recorded during revisit recorded in red.

Conclusions: In this particular study, Coastal Carolina University and Palmetto Glen are considered to be residential areas as opposed high foot traffic areas such as Ocean Boulevard, Market Common and Garden City. The two residential areas had the lowest percentage of trash debris in their drains compared to those in high foot traffic areas.

Large densities of trash debris in a drain may be a result of high foot traffic during the summer months when the coast is experiencing high tourism. Every year South Carolina's Grand Strand sees an average of 14 million people per year. (http://www.myrtlebeachareachamber.com/research/data_and_statistics.html).

All of the data from the revisited storm drains were collected during the late spring and summer months which is when the coast experiences most of its tourism. It is quite possible that if the drains located in high foot traffic areas were revisited during winter months there may have been less trash present in the storm drains due to a lower population of tourists.

The coastal area experienced unusually high rainfall for a two week duration associated with Tropical Storm Isaac. Coastal Carolina University and Market Common were visited during this time. It is possible that heavy rains could have washed debris through the storm sewer system at Coastal Carolina University and into the drains at Market Common.

Future Research: To provide more quantitative data, the program could benefit from developing a mechanism to measure the density of trash debris and litter that is inside of the drains. More data could also be collected by revisiting more locations and by decreasing the amount of time between the original marking date and the date of revisit. It would be interesting if data were collected every 3 months so that trash debris could be compared seasonally. Finally, it would be beneficial if "invisible pollutants" such as fertilizers or pesticides could be measured.